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# **Program of Studies Elementary Schools**

## **Science**

**Optional Implementation – September 1995**

**Final approval of this program and provincial  
implementation is scheduled for September 1996.**

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**CURRICULUM STANDARDS BRANCH**

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# SCIENCE

## A. PROGRAM OVERVIEW

### RATIONALE

Children have a natural curiosity about their surroundings—a desire to explore and investigate, see inside things, find out how things work and find answers to their questions. Learning about science provides a framework for students to understand and interpret the world around them.

An elementary science program engages students in a process of inquiry and problem solving in which they develop both knowledge and skills. The purpose of the program is to encourage and stimulate children's learning by nurturing their sense of wonderment, by developing skill and confidence in investigating their surroundings, and by building a foundation of experience and understanding upon which later learning can be based.

Elementary and secondary science programs help prepare students for life in a rapidly changing world—a world of expanding knowledge and technology in which new challenges and opportunities continually arise. Tomorrow's citizens will live in a changing environment in which increasingly complex questions and issues will need to be addressed. The decisions and actions of future citizens needs to be based on an awareness and understanding of their world, and on the ability to ask questions, seek answers, define problems and find solutions.

### PHILOSOPHY

The science program of studies is built on the following principles:

- **Children's curiosity provides a natural starting point for learning.**

Young children are natural inquirers and problem solvers. They have a keen interest in the materials around them, and move naturally into activities that involve manipulation of materials, exploration and discovery. Science in the elementary school years should nurture and extend this curiosity so that students continue to question, explore and investigate, with increasing levels of insight and skill.

- **Children's learning builds on what they currently know and can do.**

Children's initial concepts of the world influence what they observe and how they interpret events they experience. They enter school having learned a great deal about their world through play and exploration. They show extensive practical knowledge about materials in their environment, as well as the ability to observe, question, test, construct and create. Science experiences in the elementary years are designed to build on the knowledge



that students already have, and extend and sharpen their investigative skills.

As children progress in learning they not only add to their knowledge, but also modify their way of viewing the world. Where, in the early years, children view their experiences as personal and immediate, in later years, they become aware of order and continuity in the world extending beyond their personal experience. As they grow in this awareness, they discover new patterns in things—patterns of structure, patterns in the order of events, and patterns in the way that materials interact. The science program is designed to assist students discover and interpret these patterns, and help them connect new ideas with their existing knowledge structures.

- **Communication is essential for science learning.**

Language provides a means for students to develop and explore their ideas—and express what they have learned. By communicating their questions, observations, discoveries, predictions and conclusions they can refine and consolidate their learning; and identify new connections and avenues to explore. As children relate their experiences and ideas to one another, they naturally make new connections that only are fully realized once they are put into words.

Language also plays a role in developing the skills of inquiry and problem solving. The actions of identifying problems, asking questions and proposing ideas requires the use of a particular kind of language. The ability to define problems and ask clear questions is a keystone to growth in this area.

- **Students learn best when they are challenged and actively involved.**

Students learn best when they become personally involved in their learning—not just mechanically following a set of steps or just reading and hearing about things learned by

others. Active inquiry and problem solving can be stimulated by providing an initial focus and challenge for learning, by engaging students in developing or adapting a plan of action, and by involving students in evaluating results. By participating and reflecting on the meaning of what they do, students develop the skills of learning how to learn, and achieve depth in their understanding.

- **Confidence and self-reliance are important outcomes of learning.**

Children develop confidence when their ideas and contributions are valued and when there is a supportive climate for learning. By providing opportunities for students to explore ideas and materials, engage in open-ended activities, and evaluate their own progress, they can be encouraged to take initiative in learning. When questions and problems are referred back to students, and their ideas and decisions are supported, they learn to become more self-reliant. Confidence is achieved as students recognize that the knowledge and skills they have gained enable a measure of independent action.

The personal skills that students develop in school—the ability to make decisions, to plan and evaluate their own progress—are skills that apply throughout life.

## **PROGRAM EMPHASIS**

Children learn to inquire and solve problems in a variety of contexts. Each subject area within the elementary program provides a rich source of topics for developing questions, problems and issues that provide starting points for inquiry and problem solving. By engaging in the search for answers, solutions and decisions, students have a purpose for learning and an opportunity to develop concepts and skills within a meaningful context.

The learner expectations for the elementary science program are linked to two main areas of

skill emphasis: science inquiry and problem solving through technology. The skills developed in these two areas are related but have a somewhat different focus. In science inquiry, the focus is on asking questions and finding answers based on evidence. The outcome of inquiry is knowledge. In problem solving through technology, the focus is on practical tasks—finding ways of making and doing things to meet a given need, using available materials. The outcome of problem solving is a product or process that one can use.

## **Science Inquiry**

Inquiry is the process of finding answers to questions. The skills of science inquiry include asking questions, proposing ideas, observing, experimenting, and interpreting the evidence that is gathered. Observation and evidence are key elements.

An inquiry may be initiated in a variety of ways. It may be based on a question brought to the classroom by a teacher or student; or it may arise out of an activity, an interesting observation, an unexplained event, or a pattern that appears worth pursuing. Engagement in inquiry is not a linear process; it can have a variety of starting points, and the steps that are followed may vary from one inquiry activity to another. When an unexpected observation is made, or a procedure does not work, there is opportunity for new ideas to emerge and a new set of procedures to be followed.

## **Problem Solving through Technology**

Problem solving refers to a variety of processes used to obtain a desired result. The skills of problem solving include identifying what is needed, proposing ways of solving the problem, trying out ideas, and evaluating how things work.

In problem solving, as in inquiry, the process is usually not a linear one. Often, processes that will be needed to solve a problem are not foreseen in advance, and there may be repeated cycles of reflection, developing new ideas, and trying new approaches, all within the larger pattern of the activity.

Challenging problems requires persistence. An idea may not work at first, but with careful observation, adjustment, reflection and refinement, a solution that is close to the original idea may be found. Student success in inquiry and problem solving is enhanced when students have the opportunity to explore materials in an unstructured way before starting formal investigations. Progress frequently involves trial and error, in which initial ideas are discarded and new ideas and processes are developed. A supportive climate for trying new ideas can be critically important to the development of student confidence and competence in their investigative skills.

## PROGRAM STRUCTURE

The elementary science program has been designed as a series of five topics for each grade. Each topic may be developed as a separate unit of study or linked to other topics and other subject areas.

The order of topics within a grade may be varied as part of the instructional plan. Some topics lend

themselves to development over the course of the school year; for example, Seasonal Changes. Others may be developed as discrete units. Each grade includes one topic that emphasizes problem solving through technology; and, except for Grade 1, there is a corresponding topic emphasizing inquiry.

Grade	Topic	Emphasis
1	A. Creating Colour B. Seasonal Changes C. Building Things D. Senses E. Needs of Animals and Plants	Science Inquiry Science Inquiry Problem Solving through Technology Science Inquiry Science Inquiry
2	A. Exploration of Liquids B. Buoyancy and Boats C. Magnetism D. Hot and Cold and Temperature E. Small Crawling and Flying Animals	Science Inquiry Problem Solving through Technology Science Inquiry Science Inquiry Science Inquiry
3	A. Rocks and Minerals B. Building with a Variety of Materials C. Testing Materials and Designs D. Hearing and Sound E. Animal Life Cycles	Science Inquiry Problem Solving through Technology Science Inquiry Science Inquiry Science Inquiry
4	A. Waste and Our World B. Wheels and Levers C. Building Devices and Vehicles that Move D. Light and Shadows E. Plant Growth and Changes	Science Inquiry Science Inquiry Problem Solving through Technology Science Inquiry Science Inquiry
5	A. Electricity and Magnetism B. Mechanisms Using Electricity C. Classroom Chemistry D. Weather Watch E. Wetland Ecosystems	Science Inquiry Problem Solving through Technology Science Inquiry Science Inquiry Science Inquiry
6	A. Air and Aerodynamics B. Flight C. Sky Science D. Evidence and Investigation E. Trees and Forests	Science Inquiry Problem Solving through Technology Science Inquiry Science Inquiry Science Inquiry

For each grade, a set of skill and attitude expectations are identified. Skill expectations are arranged under three headings: Focus, Explore and Investigate, and Reflect and Interpret. This organization of skill expectations reflects a general pattern of skill use within science

activities, but is not intended as a fixed instructional sequence. As students proceed through their explorations and investigations there likely will be many points where they reflect on the progress of the activity and set a new focus.



## B. LEARNER EXPECTATIONS

### GRADE 1

#### SKILLS

*These skills apply to the five topics of study identified for Grade 1. The organization of these skills reflects a general pattern of science activity, not a fixed instructional sequence. At Grade 1, students normally will show independence in exploratory activities but require teacher direction in following a structured approach to investigating questions and problems.*

Science Inquiry	Problem Solving through Technology
<b>General Learner Expectations</b> <i>Students will be able to:</i> <b>1-1</b> Bring focus to investigative activities based on questions asked by self and by others. <b>1-2</b> Describe materials and objects that have been observed and manipulated, and identify what was done and found out.	<b>General Learner Expectation</b> <i>Students will be able to:</i> <b>1-3</b> Use, with guidance, materials provided to create a structure that achieves a given purpose.
<b>Specific Learner Expectations</b> <i>Students will be able to:</i> <b>Focus</b> <ul style="list-style-type: none"> <li>ask questions that lead to exploration and investigation</li> <li>predict what they think will happen or what they might find</li> </ul> <b>Explore and Investigate</b> <ul style="list-style-type: none"> <li>manipulate materials and make observations that are relevant to questions asked</li> <li>identify materials used</li> <li>recognize and describe steps followed, based on independent activity, on directed activity, and on observing the activity of others</li> </ul> <b>Reflect and Interpret</b> <ul style="list-style-type: none"> <li>describe what was observed using pictures and oral language</li> <li>identify questions being investigated, and what was learned about each question</li> <li>identify new questions that arise from what was learned.</li> </ul>	<b>Specific Learner Expectations</b> <i>Students will be able to:</i> <b>Focus</b> <ul style="list-style-type: none"> <li>identify the problem or task (What do we need to make?)</li> </ul> <b>Explore and Investigate</b> <ul style="list-style-type: none"> <li>attempt, with guidance, one or more strategies to complete the task</li> <li>engage in all parts of the task</li> <li>identify materials used</li> <li>recognize and describe steps followed, based on independent activity, on directed activity, and on observing the activity of others</li> </ul> <b>Reflect and Interpret</b> <ul style="list-style-type: none"> <li>describe the product(s) of the activity, using pictures and oral language</li> <li>identify processes by which the product was made</li> <li>identify how the product might be used,</li> </ul>

## ATTITUDES

*These attitudes apply across the five topics of study identified for Grade 1.*

### General Learner Expectation

*Students will be able to:*

- 1–4 Demonstrate positive attitudes for the study of science and for the application of science in responsible ways.**

### Specific Learner Expectations

*Students will show growth in acquisition and application of the following traits:*

- curiosity
- confidence in personal ability to explore materials and learn by direct study
- inventiveness
- perseverance: staying with an investigation over a sustained period of time
- appreciation of the value of experience and careful observation
- a willingness to work with others and to consider their ideas
- a sense of responsibility for actions taken
- respect for living things and environments, and commitment for their care.

## UNDERSTANDINGS

### Topic A: Creating Colour

#### Overview

Students explore coloured materials, learning about different forms of colours, how they are created, what happens when they are mixed, and how they can be transferred from one material to another. Students learn to distinguish and describe colours, and work with a variety of materials to create, modify and apply colours. In the process, students learn that different materials have particular properties, and that the properties and interactions of materials have to be taken into account when they are used for a specific purpose.

### General Learner Expectation

*Students will be able to:*

- 1–5 Identify and evaluate methods for creating colour and for applying colours to different materials.**

### Specific Learner Expectations

*Students will be able to:*

1. Identify colours in a variety of natural and manufactured objects.
2. Compare and contrast colours, using terms such as lighter than, darker than, more blue, brighter than.
3. Order a group of coloured objects based on a given colour criterion.
4. Predict and describe changes in colour that result from the mixing of primary colours; and from mixing a primary colour with white or with black.
5. Create a colour that matches a given sample by mixing the appropriate amounts of two primary colours.
6. Distinguish colours that are transparent from those which are not. Students should recognize that some coloured liquids and gels can be seen through and are thus transparent; and that other colours are opaque.
7. Compare the effect of different thicknesses of paint. Students should recognize that a very thin layer of paint, or a paint that has been watered down, may be partly transparent.

8. Compare the adherence of a paint to different surfaces, for example, different forms of papers, fabrics and plastics.
  9. Demonstrate that colour can sometimes be extracted from one material and applied to another; for example, by extracting a vegetable dye, or by dissolving and transferring a water-soluble paint.
  10. Demonstrate at least one way to separate sunlight into component colours.
- production of young on a seasonal basis.
  3. Identify human preparations for seasonal change and activities that are done on a seasonal basis.
  4. Record observable seasonal changes over a period of time.

## Topic B: Seasonal Changes

### Overview

Students learn that changes in their environment occur in a regular pattern known as the seasons. They explore weather change, and how the ups and downs of weather affect their own lives. Looking beyond themselves and beyond the immediate weather, students are guided to discover that there are larger patterns of change that affect the life habits of many living things. The interactions among different parts of the environment, and the recurrence of change as part of a cycle, are important science ideas that are introduced in this topic.

### General Learner Expectation

*Students will be able to:*

- 1–6 Describe seasonal changes, and interpret the effects of seasonal changes on living things.**

### Specific Learner Expectations

*Students will be able to:*

1. Describe the regular and predictable cycle of seasonal changes:
  - changes in sunlight
  - changes in weather.
2. Identify and describe examples of plant and animal changes that occur on a seasonal basis:
  - changes in form and appearance
  - changes in location of living things
  - changes in activity; for example, students should recognize that many living things go

## Topic C: Building Things

### Overview

Students learn about materials by using them to construct a variety of objects, including model buildings, toys, boats and vehicles. Students select materials, and gain experience as they cut, shape, fold and pile materials one on top of the other, join parts, and try different techniques to achieve the intended result. In the process, they learn to look at objects that are similar to what they are trying to construct and, with guidance, begin to recognize the component parts that make up the whole.

### General Learner Expectations

*Students will be able to:*

- 1–7 Use a variety of different materials in constructing objects and models of objects.**
- 1–8 Identify the purpose of different components of a personally constructed object or model, and identify corresponding components in a related object or model.**

### Specific Learner Expectations

*Students will be able to:*

1. Select appropriate materials, such as papers, plastics, woods, and design and build objects based on the following kinds of construction tasks:



- construct model buildings; for example, homes (human, animal, from other cultures), garages, schools
  - construct model objects; for example, furniture, equipment, boats, vehicles
  - construct toys; for example, pop-ups, figures
  - create wind- and water-related artifacts; for example, dams, waterwheels, boats.
2. Identify component parts of personally constructed objects, and describe the purpose of each part.
  3. Compare two objects that have been constructed for the same purpose, identify parts in one object that corresponds to parts in another, and identify similarities and differences between them.
  4. Recognize that products are often developed for specific purposes, and identify the overall purpose for each model and artifact constructed.

## Topic D: Senses

### Overview

Students develop a consciousness of their own senses and how they are used. They learn that each of their senses provides an awareness of particular aspects of our environment, and that together the senses enable us to know things and do things that we would not otherwise be able to do; or at least not as easily. Students learn about the function of their senses, how they are cared for, how they could be damaged, how one's own ability to sense things may differ from those of other people and other living things. Through this topic students learn to sharpen the use of their senses and describe as accurately as possible the information that their senses provide.

### General Learner Expectations

*Students will be able to:*

- 1–9 Use a variety of senses in making general and specific observations, and communicate observations orally and by producing captioned pictures.

- 1–10 Describe the role of the human senses, and the senses of other living things in enabling perception and action.

### Specific Learner Expectations

*Students will be able to:*

1. Identify each of the senses and explain how we use our senses in interpreting the world.
2. Identify ways that our senses contribute to our safety and quality of life.
3. Apply particular senses in identifying and describing objects or materials provided, and in describing living things and environments. Students meeting this expectation will be able to describe characteristics, such as colour, shape, size, texture, smell and sound.
4. Recognize the limitations of our senses, and identify example situations where our senses can mislead us; for example, feeling hot or cold, optical illusions, tasting with a plugged nose.
5. Recognize that other living things have senses, and identify examples of ways that various animals use their senses; for example, sensing danger, finding food, recognizing their own young, recognizing a potential mate.
6. Describe ways that people adapt to limited sensory abilities, or to the loss of a particular sense; for example, colour blindness, inability to see objects at close range.
7. Describe ways that to take care of our sensory organs, in particular, our eyes and ears.

## Topic E: Needs of Animals and Plants

### Overview

Students learn what living things are and what they need to live and grow. By studying a variety of living things students become familiar with similarities and differences, and develop skills for describing and classifying what they see. As the topic progresses, attention is focused on how living things survive, what they need, and how their needs are met. Through the topic students

become aware that groups of living things may share some common needs, and that different animals and plants meet those needs in different ways. Students also learn about their own responsibility in caring for living things.

### **General Learner Expectation**

*Students will be able to:*

#### **1–11 Describe some common living things, and identify needs of those living things.**

### **Specific Learner Expectations**

*Students will be able to:*

1. Observe, describe and compare living things.
2. Contrast living and nonliving things.
3. Identify ways in which living things are valued; e.g., as part of a community of living things, as sources of food, clothing or shelter.
4. Classify some common local plants and animals into groups on the basis of visible characteristics; e.g. adaptations for survival, such as claws, beaks, prickles.
5. Identify examples of plants and animals that are normally under human care (domesticated) and ones that are normally independent of human care (wild).
6. Identify the requirements of animals for maintaining life; i.e., air, food, water, shelter, space, and recognize that we must provide these to animals in our care.
7. Identify the requirements of plants to maintain life; i.e., light, suitable temperature, water, growing medium, space; and recognize that we must provide these to plants in our care.
8. Identify ways that land plants depend on soil.
9. Recognize that some plants and animals must adapt to extreme conditions to meet their basic needs; for example, arctic and desert plants and animals.
10. Give examples of ways in which animals depend on plants, and ways in which plants depend on animals; for example, particular plants may serve as a source of food and shelter, animals may help spread pollen and seeds.

## GRADE 2

### SKILLS

*These skills apply to the five topics of study identified for Grade 2. The organization of these skills reflects a general pattern of science activity, not a fixed instructional sequence. At Grade 2, students normally will show independence in exploratory activities but require teacher direction in developing a structured approach to investigating questions and problems.*

Science Inquiry	Problem Solving through Technology
<b>General Learner Expectations</b> <i>Students will be able to:</i> <b>2-1 Investigate, with guidance, the nature of things, demonstrating an understanding of procedures followed and confidence in their abilities to learn by direct investigation.</b> <b>2-2 Recognize pattern and order in objects and events studied and, with guidance, record procedures and observations, using pictures and words; and make predictions and generalizations based on their observations.</b>	<b>General Learner Expectation</b> <i>Students will be able to:</i> <b>2-3 Construct, with guidance, an object that will satisfy a given purpose.</b>
<b>Specific Learner Expectations</b> <i>Students will be able to:</i> <b>Focus</b> <ul style="list-style-type: none"> <li>ask questions that lead to exploration and investigation</li> <li>identify one or more possible answers to questions asked by self and others. Ideas may take the form of predictions and hypotheses</li> </ul> <b>Explore and Investigate</b> <ul style="list-style-type: none"> <li>use, with guidance, print and other sources of information provided. Sources may include library, classroom and computer-based resources</li> <li>attempt, with guidance, one or more strategies to answer a question posed</li> <li>identify materials used and how they are used</li> <li>collect data through direct observation and manipulation of materials</li> <li>follow simple procedures described by others</li> </ul> <b>Reflect and Interpret</b> <ul style="list-style-type: none"> <li>communicate observations orally and through captioned pictures</li> <li>describe and explain results (explanations may reflect an early stage of concept development)</li> <li>identify applications of what was learned</li> <li>identify new questions that arise from the investigation.</li> </ul>	<b>Specific Learner Expectations</b> <i>Students will be able to:</i> <b>Focus</b> <ul style="list-style-type: none"> <li>identify the purpose of the object to be constructed: What do we need to make? What does it need to do?</li> </ul> <b>Explore and Investigate</b> <ul style="list-style-type: none"> <li>use, with guidance, print and other sources of information provided. Sources may include library, classroom and computer-based resources</li> <li>attempt, with guidance, a variety of strategies to complete tasks</li> <li>identify materials used and how they are used</li> <li>identify steps followed in constructing the object and testing it to see if it works</li> <li>engage in all parts of the task, and allow others to make their contributions</li> </ul> <b>Reflect and Interpret</b> <ul style="list-style-type: none"> <li>communicate results of construction activities orally, captioned pictures and simple graphs (pictographs and bar graphs)</li> <li>describe the product, and describe and explain the processes by which it was built</li> <li>identify applications of what was built.</li> </ul>



## ATTITUDES

*These attitudes apply across the five topics of study identified for Grade 2.*

### General Learner Expectation

*Students will be able to:*

- 2–4 Demonstrate positive attitudes for the study of science and for the application of science in responsible ways.**

### Specific Learner Expectations

*Students will show growth in acquisition and application of the following traits:*

- curiosity
- confidence in personal ability to explore materials and learn by direct study
- inventiveness
- perseverance: staying with an investigation over a sustained period of time
- appreciation of the value of experience and careful observation
- a willingness to work with others and to consider their ideas
- a sense of responsibility for actions taken
- respect for living things and environments, and commitment for their care.

## UNDERSTANDINGS

### Topic A: Exploring Liquids

#### Overview

Students learn about the nature of liquids and their interactions with other materials. They explore liquids by examining droplets, watching liquids trickle down slopes, investigating flow rates, and observing liquid interactions with a variety of materials. They learn that some materials are impervious to liquids, while others are absorbent; and that some liquids mix readily while others do not. They observe that liquid water can be changed to ice or to steam, and back again, if heated and cooled, and that wet materials dry out when left open to the air. Through this topic students learn that water is our most important liquid, that we use water in many ways, and that water is essential to life.

### General Learner Expectations

*Students will be able to:*

- 2–5 Describe some properties of water and other liquids, and recognize the importance of water to living and nonliving things.**
- 2–6 Describe the interaction of water with different materials, and apply that knowledge to practical problems of drying, liquid absorption and liquid containment.**

### Specific Learner Expectations

*Students will be able to:*

1. Recognize and describe characteristics of liquids:
  - recognize and describe liquid flow
  - describe the shape of drops
  - describe the surface of calm water.
2. Compare tap water with one or more other liquids such as cooking oil, glycerine, or water mixed with liquid detergent. Comparisons may be based on characteristics such as colour, ease of flow, tendency of

drops to “bead” (form a ball shape), interactions with other liquids, and interactions with solid materials.

3. Compare the amount of liquid absorbed by different materials; for example, students should recognize that some forms of paper are very absorbent but that other forms of paper are not.
4. Evaluate the suitability of different materials for containing liquids. Students should recognize that materials such as writing paper and unglazed pottery are not waterproof and would not be suitable as containers; but that waxed paper and glazed pottery are waterproof and thus could be used in constructing or lining a liquid container.
5. Demonstrate an understanding that liquid water can be changed to other forms:
  - recognize that on cooling, liquid water freezes into ice; and that on heating it melts back into liquid water with properties the same as before
  - recognize that on heating, liquid water may be changed into steam or water vapor, and that this change can be reversed on cooling
  - identify examples in which water is changed from one form to another.
6. Predict that water in open containers or on open surfaces will evaporate, but that water in closed containers or on covered surfaces will not.
7. Predict that a wet surface will dry more quickly when subject to wind or heating; and apply this understanding to practical situations such as drying of paints, clothes and hair.
8. Recognize that water is a component of many materials and of living things.
9. Recognize human responsibilities for maintaining clean supplies of water, and identify actions that are taken to ensure that water supplies are safe.

## Topic B: Buoyancy and Boats

### Overview

Students investigate what sinks and what floats, and what makes an effective watercraft. Through building and testing a variety of water-borne objects, students learn the importance of selecting appropriate materials, and the importance of workmanship in shaping, positioning, fitting and waterproofing their constructions so they will do the intended job. Along the way, students learn about balance and stability and about different methods that can be used in propelling a watercraft. The concept of density is informally developed in this topic.

### General Learner Expectation

*Students will be able to:*

- 2–7 Construct objects that will float on and move through water, and evaluate various designs for watercraft.**

### Specific Learner Expectations

*Students will be able to:*

1. Describe, classify and order materials on the basis of their buoyancy. Students who have achieved this expectation will distinguish between materials that sink in water and those that float. They will also be aware that some “floaters” sit mostly above water, while others sit mostly below water. The terms buoyancy and density may be introduced, but are not required as part of this learning expectation.
2. Alter or add to a floating object so that it will sink; and alter or add to a nonfloating object so that it will float.
3. Assemble materials so they will float, carry a load and be stable in water.
4. Modify a watercraft to increase the load it will carry.
5. Modify a watercraft to increase its stability in water.

6. Evaluate the appropriateness of various materials to the construction of watercraft, in particular:
  - the degree to which the material is waterproof (not porous)
  - the ability to form waterproof joints between parts
  - the stiffness or rigidity of the material
  - the buoyancy of the material.
7. Develop or adapt methods of construction that are appropriate to the design task.
8. Adapt the design of a watercraft so it can be propelled through water.
9. Explain why a given material, design, or component is appropriate to the design task.

## Topic C: Magnetism

### Overview

Students explore the interaction of magnets with a variety of materials found within their own environment. By testing the effects of one magnet on another they learn that magnets show polarity and that the strength of magnetic effects diminishes with distance. They learn to distinguish materials that are affected by magnets from those that do not and learn how magnets can be used in sorting objects, moving things and holding things together.

### General Learner Expectation

*Students will be able to:*

- 2–8 Describe the interaction of magnets with other magnets and with common materials.**

### Specific Learner Expectations

*Students will be able to:*

1. Identify where magnets are used in their environment and why they are used.
2. Distinguish materials that are attracted by a magnet from those that are not.
3. Recognize that magnets attract materials with iron (or steel) in them; and given a variety of

- metallic and nonmetallic objects, predict those that will be attracted by a magnet.
4. Recognize that magnets have polarity; demonstrate that poles may either repel or attract each other; state a rule for when poles will repel or attract each other.
5. Design and produce a device that uses a magnet.
6. Demonstrate that most materials are transparent to the effects of a magnet. A magnetic field will “pass through” such materials, whereas other materials interact with a magnet.

## Topic D: Hot and Cold and Temperature

### Overview

Students learn that materials are sometimes changed by heating or cooling, and that by observing such changes they can infer how hot or cold an object is. They learn that thermometers provide a helpful way to measure and describe the hotness or coldness of things—a more reliable way than provided by their own senses. Students observe that temperatures can go up and down, including the temperature of their surroundings and the temperature of particular objects within it. They also learn about methods that are used to control temperature in buildings and how insulation is used to keep things hot or cold.

### General Learner Expectation

*Students will be able to:*

- 2–9 Recognize the effects of heating and cooling, and identify methods for heating and cooling.**

### Specific Learner Expectations

*Students will be able to:*

1. Describe temperature in relative terms, using expressions such as hotter than, colder than.
2. Measure temperature in degrees Celsius (°C).
3. Describe how heating and cooling materials can often change them; for example, melting and freezing, cooking, burning.



4. Identify safe practices for handling hot materials and for avoiding potential dangers from heat sources.
5. Recognize that the human body temperature is relatively constant and that a change in body temperature often signals a change in health.
6. Identify ways in which the temperature in homes and buildings can be adjusted; for example, by turning a thermostat up or down, opening or closing windows, using a space heater in a cold room.
7. Describe, in general terms, how local buildings are heated:
  - identify the fuel
  - recognize that most buildings are heated by circulating hot air or hot water
  - describe how heat is circulated through the school building, and in their own home.
8. Describe the role of insulation in keeping things hot or cold, and identify places where some form of insulation is used; for example, clothing, refrigerator, coolers, homes.
9. Identify materials that insulate animals from the cold; for example, wool, fur and feathers, and materials that are used by humans for the same purpose.
10. Design and construct a device to keep something hot or cold.
11. Describe ways in which temperature changes affect us in our daily lives.

## **Topic E: Small Crawling and Flying Animals**

### Overview

Students learn about the structure and life habits of animals by studying small animals that live in their own community. By investigating outdoor spaces in and around the school and their homes, students discover a wide range of animals that find shelter and food within the local area. In studying these animals they learn about where they live, what they eat, what they are eaten by, and features of the animals that suit them to their particular environment.

## **General Learner Expectation**

*Students will be able to:*

- 2–10 Describe the general structure and life habits of small crawling and flying animals; e.g., insects, spiders, worms, slugs, and apply this knowledge in interpreting local species that have been observed.**

## **Specific Learner Expectations**

*Students will be able to:*

1. Recognize that there are many different kinds of small crawling and flying animals, and identify a range of examples that are found locally.
2. Compare and contrast small animals that are found in the local environment. Example animals should include at least three invertebrates, that is animals such as insects, spiders, centipedes, slugs, worms.
3. Recognize that small animals, like humans, have homes where they meet their basic needs of air, food, water, shelter and space; and describe any special characteristics that help the animal survive in its particular home.
4. Identify each animal's role within the food chain. To meet this expectation students should be able to identify the animals as plant eaters, animal eaters or decomposers; and identify other animals that may use them as food source.
5. Describe the relationships of these animals to other living and nonliving things in their habitat, and to people.
6. Identify and give examples of ways that small animals avoid predators, including camouflage, taking cover in burrows, use of keen senses and flight.
7. Describe conditions for the care of an example small animal, and demonstrate responsible care in maintaining the animal for a few days or weeks.
8. Identify ways in which animals are considered helpful or harmful to humans and to the environment.

## GRADE 3

### SKILLS

*These skills apply to the five topics of study identified for Grade 3. The organization of these skills reflects a general pattern of science activity, not a fixed instructional sequence. At Grade 3, students normally will show independence in exploratory activities but require teacher guidance in developing a structured approach to investigating questions and problems. At this level students should recognize the purpose of at least some of the steps followed in investigating questions and problems.*

Science Inquiry	Problem Solving through Technology
<b>General Learner Expectations</b> <i>Students will be able to:</i>  <b>3-1 Work individually or with others in investigating the nature of things, demonstrating purposeful action leading to observations and inferences.</b>  <b>3-2 Identify patterns and order in objects and events studied and, with guidance, record observations through pictures, words and charts; and make predictions and generalizations based on their observations.</b>	<b>General Learner Expectation</b> <i>Students will be able to:</i>  <b>3-3 Work individually or with others in designing and carrying out an investigation of a practical problem and in developing a possible solution; given a problem that involves creating a structure that can be built with available materials.</b>

<b>Specific Learner Expectations</b> <i>Students will be able to:</i>  <b>Focus</b> <ul style="list-style-type: none"> <li>ask questions that lead to exploration and investigation</li> <li>identify one or more possible answers to questions by stating hypotheses or predictions</li> </ul> <b>Explore and Investigate</b> <ul style="list-style-type: none"> <li>identify, with guidance, sources for information and ideas; and with guidance, access information and ideas from those sources. Sources may include library, classroom and computer-based resources</li> <li>identify, with guidance, procedures to be followed in finding answers to given questions</li> <li>identify materials to be used and how they will be used</li> <li>collect data through direct observation and manipulation of materials</li> <li>work independently or with others to carry out the identified procedures</li> </ul>	<b>Specific Learner Expectations</b> <i>Students will be able to:</i>  <b>Focus</b> <ul style="list-style-type: none"> <li>identify the purpose of the object to be constructed: What is to be developed? What is it for?</li> </ul> <b>Explore and Investigate</b> <ul style="list-style-type: none"> <li>identify, with guidance, sources for information and ideas; and with guidance access information and ideas from those sources. Sources may include library, classroom and computer-based resources</li> <li>identify materials to be used, and how they will be used</li> <li>identify steps to be followed in completing the task, and explain the purpose of each step</li> <li>engage in all parts of the task and support the efforts of others</li> <li>attempt a variety of strategies to complete tasks</li> </ul>
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<b>Reflect and Interpret</b> <ul style="list-style-type: none"> <li>record observations and measurements, using captioned pictures and charts, with guidance in the construction of charts. (Computer resources may be used as a record keeping tool and for display and interpretation of data.)</li> <li>state an inference based on observations</li> <li>identify applications of what was learned</li> <li>identify new questions that arise from the investigation.</li> </ul>	<b>Reflect and Interpret</b> <ul style="list-style-type: none"> <li>communicate results of construction activities using written and oral language and pictures</li> <li>evaluate the product and identify possible improvements</li> <li>identify new applications of the design or method of construction.</li> </ul>
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## ATTITUDES

*These attitudes apply across the five topics of study identified for Grade 3.*

### General Learner Expectation

*Students will be able to:*

**3–4 Demonstrate positive attitudes for the study of science and for the application of science in responsible ways.**

### Specific Learner Expectations

*Students will show growth in acquisition and application of the following traits:*

- curiosity
- confidence in personal ability to explore materials and learn by direct study
- inventiveness and willingness to consider new ideas
- perseverance in the search for understandings and for solutions to problems
- a willingness to base their conclusions and actions on the evidence of their own experience
- a willingness to work with others in a shared activity and in the sharing of experience
- appreciation of the benefits to be gained from shared effort and cooperation
- a sense of responsibility for personal and group actions
- respect for living things and environments, and commitment for their care.

## UNDERSTANDINGS

### Topic A: Rocks and Minerals

#### Overview

Students learn about materials found on the Earth's surface—rocks, minerals and soil. By closely examining sample rocks students discover similarities and differences and explore these,

using simple tests and tools. Students learn that each kind of rock has a set of characteristics, and that these can be used in classifying and identifying them. In studies of soil, students discover that the component materials include rock fragments and remains of living things, and that different soils have different composition. Students learn that rock and soil characteristics are important to their use within the community.



## General Learner Expectation

*Students will be able to:*

- 3–5 Demonstrate knowledge of materials that comprise Earth's crust, and demonstrate skill in classifying these materials.**

## Specific Learner Expectations

*Students will be able to:*

1. Compare samples of various kinds rock, and identify similarities and differences.
2. Given a description of the properties of a given rock or mineral, identify a sample rock or mineral that matches those properties. Properties that students should be able to interpret and apply include:
  - colour
  - lustre or “shininess”; e.g., shiny, dull, glassy, metallic, earthy
  - texture; e.g., rough, smooth, uneven
  - hardness, based on scratch tests with available materials
  - vinegar (acid) test
  - crystal shape for minerals, or overall pattern of rocks.
3. Describe and classify a group of rocks and minerals based upon the above properties.
4. Recognize that rocks are composed of a variety of materials, and given a coarse-grained rock and magnifier, describe some of the component materials.
5. Recognize and describe the various components within a sample of soil; for example clay, sand, pebbles, decaying plants, and describe differences between two different soil samples.
6. Describe ways in which rocks break down to become soil, and demonstrate one or more of these ways; for example, by shaking a group of small soft rocks in a jar of water, striking rocks together.  
**Note:** Safety goggles should be used.
7. Describe some common uses of rocks and minerals, and identify examples of those uses within the school, home or local community.

## Topic B: Building with a Variety of Materials

### Overview

Students use a variety of tools and simple techniques to build things for specific purposes. Their tasks may require that a bridge be built between two desks, a model lookout tower constructed, or a water container made from available materials. Through these projects students learn the value of safety and good workmanship, and that different materials and designs can be used to obtain the same result. They learn that working together on a common task is easier when ideas and materials are shared.

## General Learner Expectations

*Students will be able to:*

- 3–6 Use, safely, a variety of tools, techniques and materials in construction activities.**
- 3–7 Construct structures, using a variety of materials and designs, and compare the effectiveness of the various materials and designs for their intended purposes.**

## Specific Learner Expectations

*Students will be able to:*

1. Using a variety of materials and techniques, design, construct and test structures that are intended to:
  - support objects
  - span gaps
  - serve as containers
  - serve as models of particular living things, objects or buildings.
2. Select appropriate materials for use in construction tasks, and explain the choice of materials. Students should demonstrate familiarity with a variety of materials such as papers, woods, plastics, clay and metals.
3. Select tools that are suitable to particular tasks and materials, and use them safely and effectively.

4. Understand and use a variety of methods to join or fasten materials.
5. Identify the intended purpose and use of structures to be built, and explain how knowing the intended purpose and use helps guide decisions regarding materials and design.
6. Understand that simple designs are often as effective as more complex ones, as well as being easier and cheaper to build, and illustrate this understanding with a practical example.
7. Recognize the importance of good workmanship, and demonstrate growth toward good workmanship.
8. Maintain and store materials and tools safely and properly.
9. Apply skills of listening, speaking and cooperative decision making in working with other students on a construction project.

## Topic C: Testing Materials and Designs

### Overview

Students study the materials and designs used in construction tasks. They compare paper, clay, cardboard, styrofoam or other available materials to see which are the strongest: which ones resist bending, crushing or tearing; and which ones are most easily shaped and joined. They test different shapes and thicknesses to find out what makes a structure strong and stable, and how much material is needed. Throughout the topic students learn that many things are considered when materials and designs are selected and that different tasks may require different materials and designs.

### General Learner Expectation

*Students will be able to:*

- 3–8 Evaluate the suitability of different materials and designs for their use in a building task.

## Specific Learner Expectations

*Students will be able to:*

1. Recognize that effective structures must be sufficiently strong and stable, and that unstable or weak structures are often unsafe to use.
2. Compare and evaluate the stability of different models or objects constructed.
3. Describe the distinctive properties of some common solids, such as wood, paper or plastic, that make them suitable for use as building materials.
4. Apply procedures to test the strength of construction materials, in particular, different stocks of papers, plastics or wood.
5. Apply procedures to test different designs.
6. Apply procedures to test the strength of different methods of joining.
7. Identify and apply methods for making a structure stronger and more stable; for example, by adding or joining parts to form triangles.

## Topic D: Hearing and Sound

### Overview

Students explore the nature of sound, its sources, its qualities and what it is. They learn that sound is vibration and that changes in vibration can affect the loudness, pitch and quality of sound. They learn about sound travel, what things carry sound, what things make it louder or softer, and what happens to sound when it reaches their ears. The sensitivity of human ears and those of other animals is examined, as students learn about the safe use of this valuable sense.

### General Learner Expectation

*Students will be able to:*

- 3–9 Describe the nature of sound, and demonstrate methods for producing and controlling sound.

### Specific Learner Expectations

*Students will be able to:*

1. Identify examples of vibration.

2. Recognize that sound is the result of vibration and demonstrate that the larger the vibration, the louder the sound.
3. Recognize that there are ways of measuring the loudness of sounds and that loud sounds pose a danger to the ear.
4. Recognize that pitch is the result of differences in the rate of vibration, and predict how a change in the rate of vibration will affect a sound.
5. Demonstrate a variety of ways of producing sounds by constructing and using sound-producing devices involving vibrating strings, striking objects or by blowing air.
6. Use sound-producing devices that the student has constructed to demonstrate methods for controlling the loudness, pitch and quality of sound produced.
7. Identify examples that show that sound can travel through a variety of materials, including solids, liquids and air, and that sound travels in all directions.
8. Describe how the human ear senses vibrations.
9. Compare the range of hearing in humans and other animals; e.g., dogs and bats.
10. Recognize that certain sounds have characteristics that cause people to interpret them as pleasant or unpleasant, and identify characteristics of these sounds.
11. Describe changes in hearing that result from continued exposure to loud noise, and from the natural process of aging.
12. Construct and evaluate different kinds of soundproofing and sound-amplifying devices.
13. Explain the role that sound plays in communication.

## Topic E: Animal Life Cycles

### Overview

Students learn about the growth and development of animals and discover that different animals have different life cycles. By observing the life cycle of one small animal from its earliest stage to adulthood, students acquire a reference point for

the study of other animals and come to appreciate the beauty and fragility of life. Students learn that the *egg*, *larva*, *pupa*, and *adult* stages that are characteristic of many insects represent a different life story from that of the *egg*, *young*, *adult* life cycle that is common to most vertebrate animals. In studying these animals, students learn about the changes in needs of the young as they grow and develop, and their changing relationship to their environment.

### General Learner Expectations

*Students will be able to:*

**3–10 Describe the appearance and life cycles of some common animals, and identify their adaptations to different environments.**

**3–11 Identify requirements for animal care.**

### Specific Learner Expectations

*Students will be able to:*

1. Classify a variety of animals based on observable characteristics; e.g., limbs, teeth, body covering, overall shape, backbone.
2. Observe and describe the growth and development of at least one living animal as the animal develops from early to more advanced stages. The animal(s) should be from one or more of the following groups: mammals, birds, fish, reptiles, amphibians, insects. (Suggested examples: gerbils, guppies, mealworms, tadpoles, worms, butterflies/moths. Additional examples from other animal groups might also be included: brine shrimp, isopods, spiders.
3. Predict the next stages in the growth and development of at least one animal from each of the following groups: mammals, birds, fish, reptiles, amphibians and insects; and identify similarities and differences in their developmental sequences.
4. Identify the food needs of at least one animal from each of the following groups: mammals, birds, fish, reptiles, amphibians, insects; and describe changes in how each animal obtains food through different stages of its life.



5. Demonstrate awareness that parental care is characteristic of some animals and not of others, and identify examples of different forms of parental care.
6. Demonstrate awareness that animals require different habitats in order to meet their basic needs of food, water, shelter and space.
7. Recognize adaptations of a young animal to its environment, and identify changes in its relationship to its environment as it goes through life; e.g., tadpoles are adapted for life in an aquatic environment; adult frogs show adaptations to both terrestrial and aquatic environments.
8. Identify examples of environmental conditions that may threaten animal survival, and identify examples of extinct animals.
9. Recognize that habitat preservation can help maintain animal populations, and identify ways that student actions can assist habitat preservation.
10. Demonstrate knowledge of the needs of animals studied, and skills for their care.

## GRADE 4

### SKILLS

*These skills apply to the five topics of study identified for Grade 4. The organization of these skills reflects a general pattern of science activity, not a fixed instructional sequence. At Grade 4, students normally will show independence in exploratory activities and, with guidance, a beginning level of independence in investigating questions and problems. At this level students should be able to recognize the purpose of most steps followed in investigating questions and problems.*

Science Inquiry	Problem Solving through Technology
<b>General Learner Expectations</b> <i>Students will be able to:</i>  <b>4-1 Work individually or with others in investigating the nature of things, demonstrating purposeful action leading to inferences supported by observations.</b>  <b>4-2 Identify patterns and order in objects and events studied and, with guidance, record observations through pictures, words and charts; and make predictions and generalizations based on their observations.</b>	<b>General Learner Expectation</b> <i>Students will be able to:</i>  <b>4-3 Work individually or with others to make a structure or mechanical device that achieves a given purpose.</b>

<b>Specific Learner Expectations</b> <i>Students will be able to:</i>  <b>Focus</b> <ul style="list-style-type: none"> <li>ask questions that lead to exploration and investigation</li> <li>identify one or more possible answers to the question by stating an hypothesis or a prediction</li> </ul> <b>Explore and Investigate</b> <ul style="list-style-type: none"> <li>identify, with guidance, sources of information and ideas, and access information and ideas from these sources. Sources may include library, classroom and computer-based resources</li> <li>design or select, with guidance, procedures that comprise a “fair test”</li> <li>identify materials to be used and how they will be used</li> <li>work independently or cooperatively in carrying out the identified procedures</li> </ul>	<b>Specific Learner Expectations</b> <i>Students will be able to:</i>  <b>Focus</b> <ul style="list-style-type: none"> <li>identify the purpose of problem solving and construction activities: What problem do we need to solve? What needs must be met?</li> </ul> <b>Explore and Investigate</b> <ul style="list-style-type: none"> <li>identify, with guidance, sources of information and ideas, and access information and ideas from those sources. Sources may include library, classroom and computer-based resources</li> <li>identify steps to be followed in completing the task and testing the products</li> <li>identify various materials that may be used and how they may be used</li> <li>engage in all parts of the task and support the efforts of others</li> <li>attempt a variety of strategies and modify procedures when needed—troubleshoot problems</li> </ul>
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<b>Reflect and Interpret</b> <ul style="list-style-type: none"><li>• communicate with group members, showing ability to both contribute and receive ideas</li><li>• record observations and measurements, accurately using captioned pictures and charts, with guidance in the construction of charts. Computer resources may be used as a record keeping tool and for display and interpretation of data.</li><li>• state an inference based on observations</li><li>• identify possible applications of what was learned</li><li>• identify new questions that arise from what was learned.</li></ul>	<b>Reflect and Interpret</b> <ul style="list-style-type: none"><li>• communicate with group members, showing ability to both contribute and receive ideas</li><li>• evaluate the product and identify possible improvements</li><li>• identify new applications of the design or method of construction.</li></ul>
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## ATTITUDES

*These skills apply across the five topics of study identified for Grade 4.*

### General Learner Expectation

*Students will be able to:*

**4–4 Demonstrate positive attitudes for the study of science and for the application of science in responsible ways.**

### Specific Learner Expectations

*Students will show growth in acquisition and application of the following traits:*

- curiosity
- confidence in personal ability to explore materials and learn by direct study
- inventiveness and willingness to consider new ideas
- perseverance in the search for understandings and for solutions to problems
- a willingness to base their conclusions and actions on the evidence of their own experience
- a willingness to work with others in a shared activity and in the sharing of experience
- appreciation of the benefits to be gained from shared effort and cooperation
- a sense of responsibility for personal and group actions
- respect for living things and environments, and commitment for their care.



## UNDERSTANDINGS

### Topic A: Waste and Our World

#### Overview

Students learn about wastes produced through natural processes and human technology. In studying natural systems, students learn that all plants, animals and other living things are made up of materials that are recycled through the environment and used again and again. In studying human consumption and wastes, students identify wastes produced within their community, and learn the methods used for disposal. They learn that some waste materials are biodegradable, that some are reusable, and that others are toxic. They learn that personal action in reducing, reusing and recycling materials can help lessen the waste we accumulate.

#### General Learner Expectation

*Students will be able to:*

**4–5 Recognize that human activity can lead to the production of wastes, and identify alternatives for the responsible use and disposal of materials.**

#### Specific Learner Expectations

*Students will be able to:*

1. Identify plant and animal wastes and describe how they are recycled in nature; (for example, plant leaves serve as a source of food for soil insects, worms, and other creatures. The wastes of these creature may then be further broken down by molds and fungi.
2. Identify and classify wastes that result from human activity.
3. Describe alternative methods of disposal and identify possible advantages and disadvantages of each.
4. Distinguish between wastes which are readily biodegradable and those that are not.
5. Compare different kinds of packaging, and infer the relative advantages and disadvantages of that packaging. In

evaluating different forms of packaging, students should demonstrate the ability to consider a consumer perspective as well as an environmental perspective.

6. Identify methods of waste disposal currently used within the local community.
7. Identify kinds of wastes which may be toxic to people and to the environment.
8. Identify alternative materials and processes that may lessen the amount of waste produced; for example, reducing wastage of food, using both sides of a sheet of paper.
9. Identify ways in which materials can be reused or recycled, including examples of things that the student has done.
10. Develop a flow chart for a consumer product that indicates the source materials, final product and method of disposal.
11. Identify actions which individuals and groups can take to minimize the production of wastes, to recycle or reuse wastes, and to ensure their safe handling and disposal.
12. Develop a plan to reduce waste, and monitor what happens over a period of time.

### Topic B: Wheels and Levers

#### Overview

Students apply simple techniques and tools to building vehicles and devices that move. In constructing these objects students apply previous learnings about structures and explore new applications with wheels, rollers, gears, pulleys and a variety of levers and connectors. They learn that different forms of energy can be used to propel their model devices: in some cases a direct push, in other cases the stored energy from a compressed spring or falling weight; or in other applications, a flashlight battery. On completing their projects, students learn to evaluate their work, including the effectiveness of the device and the appropriateness of materials used.

## General Learner Expectation

*Students will be able to:*

- 4-6 Demonstrate a practical understanding of wheels, gears and levers by constructing devices in which energy and motion are transferred.**

## Specific Learner Expectations

*Students will be able to:*

1. Explain how rollers can be used to move an object, and demonstrate the use of rollers in a practical situation.
2. Compare the wheel and the roller, and identify examples where each are used.
3. Construct devices that use wheels and axles, and demonstrate and describe their use in:
  - model vehicles
  - pulley systems
  - gear systems.
4. Construct and explain the operation of a drive system that uses one or more of the following:
  - wheel-to-wheel contact
  - a belt or elastic
  - a chain
  - cogs or gears.
5. Construct and explain the operation of a drive system that transfers motion from one shaft to a second shaft, where the second shaft is:
  - parallel to the first
  - at a 90° angle to the first.
6. Describe and construct devices that demonstrate how levers accomplish the following:
  - use a force to cause movement
  - use a smaller force to create a larger force
  - use a small/large movement to create a large/small movement.
7. Construct models and explain how levers are involved in such devices as: teeter-totters, scissors, pliers, pry bars, tongs, nut crackers, fishing rods, wheel barrows.

## Topic C: Building Devices and Vehicles that Move

### Overview

Students learn about basic components of simple machines: how they are assembled, how they operate, and how they are used. They explore different techniques that can be used to transfer motion from one component to another, using simple connectors and various levers, gears, pulleys and band driven systems. As they work with these components they learn the functions that each can perform, including sample applications and ways that they can be used in a larger system. As part of their studies they examine how these simple machines are used to change the speed or force of movement.

## General Learner Expectations

*Students will be able to:*

- 4-7 Construct a mechanical device for a designated purpose, using materials and design suggestions provided.**

**Note:** One or more components of the task will be open-ended and require students to determine the specific procedure to be followed.

- 4-8 Explore and evaluate variations to the design of a mechanical device, demonstrating that control is an important element in the design and construction of that device.**

## Specific Learner Expectations

*Students will be able to:*

1. Design and construct devices and vehicles that move or have moving parts—linkages, wheels and axles.
2. Use simple forces to power or propel a device; e.g., direct pushes, pulls, use of cranking mechanisms, moving air, moving water and downhill motion.

3. Design and construct devices and vehicles that employ energy-storing or energy-consuming components that will cause motion; e.g. elastic bands, springs, gravity, wind, moving water, batteries.
4. Understand that moving from place to place requires time, and that the shorter the time the faster the movement.
5. Recognize the need for control in mechanical devices, and apply control devices where necessary.
6. Compare two designs, identifying the relative strengths and weaknesses of each.
7. In cooperation with other students, design, construct and operate a production line in which multiple sets of the same product are made.
8. Evaluate a design based on a given set of questions or criteria. The criteria/questions may be provided by the teacher or developed by the students. Example criteria include:
  - effectiveness—Does it work?
  - reliability—Does it work every time?
  - durability—Does it stand up to repeated use?
  - effort—Is it easy to construct? Is it easy to use?
  - safety—Are there any risks of hurting oneself in making it or using it?
  - use of materials—Can it be made cheaply with available materials? Does it use recycled materials, and can the materials be used again?

## Topic D: Light and Shadows

### Overview

Students learn about light by studying the effects of light on things within their environment. They learn about light sources, about materials that light can pass through, and about what happens when a material blocks or changes the path of light. By observing shadows and their motions relative to a light source, students discover that light and shadows fall along a predictable path. They discover that mirrors, prisms and a variety of other

materials can affect that path by reflecting and refracting light, and by splitting light into colours.

### General Learner Expectation

*Students will be able to:*

- 4–9 Identify sources of light, describe the interaction of light with different materials, and infer the pathway of a light beam.**

### Specific Learner Expectations

*Students will be able to:*

1. Recognize that eyes can be damaged by bright lights and that one should not look at the Sun—either directly or with binoculars or telescopes.
2. Identify a wide range of sources of light, including the sun, various forms of electric lights, flames, and luminescent materials—materials that glow.
3. Distinguish objects that emit their own light from those that require an external source of light to be seen.
4. Demonstrate that light travels outward from a source, and continues unless blocked by an opaque material.
5. Describe changes in the size and location of Sun shadows during the day—early morning to mid-day, to late afternoon.
6. Recognize that opaque materials cast shadows, and predict changes in the size and location of shadows resulting from the movement of a light source or from the movement of a shade-casting object.
7. Distinguish transparent materials from opaque materials by examining the materials or by examining their shadows.
8. Classify materials as transparent, partly transparent (translucent) or opaque.
9. Recognize that light can be reflected and that shiny surfaces, such as polished metals and mirrors, are good reflectors.
10. Compare the amount of light reflected by a light-coloured object and by a dark-coloured object.



11. Recognize that light can be bent (refracted), and that such objects as aquaria, prisms and lenses can be used to show that light beams can be bent.
12. Recognize that light can be broken into colours and that different colours of light can be combined to form a new colour.
13. Demonstrate the ability to use a variety of optical devices, describe how they are used, and describe their general structure. Suggested examples include hand lens, telescope, microscope, pin hole camera, light-sensitive paper, camera, kaleidoscope. Students meeting this expectation will be able to provide practical descriptions of the operation of such devices, but are not required to provide theoretical explanations of how the devices work.

## Topic E: Plant Growth and Changes

### Overview

Students learn about the structure and growth of plants by raising plants in the classroom and by observing plants growth within the community. They learn to recognize and describe different forms of leaves, stems, roots and flowers and learn their functions in supporting the growth and reproduction of the plant. They learn various ways of starting new plants and the plants' requirements for growth. By studying a variety of plants, students learn that different plants have different needs, and experience is gained in caring for a plant.

### General Learner Expectation

*Students will be able to:*

#### **4-10 Demonstrate knowledge and skills for the study, interpretation, propagation and enhancement of plant growth**

### Specific Learner Expectations

*Students will be able to:*

1. Describe the importance of plants to humans, and as part of the natural environment.

Students who meet this expectation should be able to give examples of plants being used as a source of food or shelter, and be aware of the role plants play in preventing erosion and maintaining oxygen.

2. Identify and describe the general purpose of plant roots, stems, leaves and flowers.
3. Describe common plants and classify them on the basis of their characteristics and uses.
4. Recognize that plant requirements for growth; i.e., air, light energy, water, nutrients and space, vary from plant to plant, and that other conditions; for example, temperature and humidity, may also be important to the growth of particular plants.
5. Identify examples of plants that have special needs.
6. Recognize that a variety of plant communities can be found within the local area, and that differences in plant communities are related to variations in the amount of light, water, and other conditions.
7. Recognize that plants of the same kind have a common life cycle, and produce new plants that are similar, but not identical, to the parent plants.
8. Describe ways that various flowering plants can be propagated, including from seed, from cuttings, from bulbs and by runners.
9. Nurture a plant through one complete life cycle—from seed to seed. [The plant *Brassica Rapa* is a fast-growing plant that is particularly suited to plant care and observation studies in a classroom setting.]
10. Describe the care and growth of a plant that students have nurtured, in particular:
  - identify the light, temperature, water, and growing medium requirements of the plant
  - identify the life stages of the plant
  - identify the reproductive structures of the plant.

## GRADE 5

### SKILLS

*These skills apply to the five topics of study identified for Grade 5. The organization of these skills reflects a general pattern of science activity, not a fixed instructional sequence. At Grade 5, students normally will show, with some guidance, independence in exploratory and investigative activities. At this level students should be able to describe the purpose of most steps followed in investigative activities.*

Science Inquiry	Problem Solving through Technology
<b>General Learner Expectations</b> <i>Students will be able to:</i> <b>5–1 Work cooperatively with others to design and carry out an investigation that comprises a fair test.</b> <b>5–2 Recognize the importance of accuracy in observation and measurement and, with guidance, apply suitable methods to record, compile and interpret observations and measurements gathered by self and group.</b>	<b>General Learner Expectation</b> <i>Students will be able to:</i> <b>5–3 Work cooperatively with other students in designing and carrying out an investigation of a practical problem and in developing a possible solution; given a problem that involves construction of a mechanical device with electrical components.</b>

<b>Specific Learner Expectations</b> <i>Students will be able to:</i> <b>Focus</b> <ul style="list-style-type: none"> <li>ask questions that lead to exploration and investigation</li> <li>identify one or more possible answers to questions by stating an hypothesis or a prediction</li> </ul> <b>Explore and Investigate</b> <ul style="list-style-type: none"> <li>identify sources for information and ideas, and access information and ideas from these sources. Sources may include library, classroom, and computer-based resources</li> <li>identify one or more ways of finding answers to given questions</li> <li>work cooperatively with other students to develop a shared plan</li> <li>identify variables that need to be held constant to ensure a fair test</li> <li>identify materials to be used and how they will be used</li> <li>work individually or cooperatively in carrying out a set of procedures</li> <li>modify procedures as necessary</li> </ul>	<b>Specific Learner Expectations</b> <i>Students will be able to:</i> <b>Focus</b> <ul style="list-style-type: none"> <li>identify problems to be solved and the purpose of the problem-solving activity. What problem are we trying to solve? What conditions must be met? What controls are required? How will we know that we have done what we set out to do?</li> </ul> <b>Explore and Investigate</b> <ul style="list-style-type: none"> <li>identify sources for information and ideas, and access information and ideas from these sources. Sources may include library, classroom, and computer-based resources</li> <li>identify one or more possible approaches to solving the problem</li> <li>identify steps to be used in completing the task, and work cooperatively with others in developing a shared plan</li> <li>engage in all parts of the task, and support the efforts of others</li> <li>attempt a variety of strategies and modify procedures when needed—troubleshoot problems</li> </ul>
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<b>Reflect and Interpret</b> <ul style="list-style-type: none"><li>• communicate with group members to share and evaluate ideas, and assess progress</li><li>• record observations and measurements accurately, using a chart format where appropriate. Computer resources may be used as a record keeping tool and for display and interpretation of data</li><li>• state an inference based on results. The inference will identify a cause and effect relationship that is supported by observations</li><li>• evaluate how well the procedures worked, and identify possible improvements</li><li>• identify possible applications of what was learned</li><li>• identify new questions that arise from what was learned.</li></ul>	<b>Reflect and Interpret</b> <ul style="list-style-type: none"><li>• communicate with group members to share and evaluate ideas, and assess progress</li><li>• evaluate the product or process developed and identify possible improvements</li><li>• evaluate the product/process in terms of the benefit to society and the effect on environments</li><li>• evaluate the procedures used to solve the problem, and identify possible improvements</li><li>• identify new applications of the design or problem solution.</li></ul>
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## ATTITUDES

*These attitudes apply across the five topics of study identified for Grade 5.*

### General Learner Expectation

*Students will be able to:*

**5-4 Demonstrate positive attitudes for the study of science and for the application of science in responsible ways.**

### Specific Learner Expectations

*Students will show growth in acquisition and application of the following traits:*

- curiosity
- confidence in personal ability to learn and develop problem-solving skills
- inventiveness and open-mindedness
- perseverance in the search for understandings and for solutions to problems
- flexibility in considering new ideas
- critical-mindedness in examining evidence and determining what the evidence means
- a willingness to use evidence as the basis for their conclusions and actions
- a willingness to work with others in a shared activity and in the sharing of experience
- appreciation of the benefits to be gained from shared effort and cooperation
- a sense of personal and shared responsibility for actions taken
- respect for living things and environments, and commitment for their care.



## UNDERSTANDINGS

### Topic A: Electricity and Magnetism

#### Overview

Students learn about electricity by building and testing circuits. Using batteries, bulbs and wires, students construct simple circuits and test the effect of various modifications. Through such tests they discover that a circuit requires a closed pathway for electricity and that some materials conduct electricity and others do not. They learn that an electric current can affect a nearby magnet and that this property of electricity is used in making electromagnets and motors. Potential dangers are examined as students learn about the safe use of electricity.

#### General Learner Expectations

*Students will be able to:*

**5–5 Demonstrate safe methods for the study of magnetism and electricity, identify methods for measurement and control, and apply techniques for evaluating magnetic and electrical properties of materials.**

#### Specific Learner Expectations

*Students will be able to:*

1. Recognize and appreciate the potential dangers involved in using sources of electrical current:
  - understand that household electrical currents are potentially dangerous and not a suitable source for experimentation
  - understand that small batteries are a relatively safe source of electricity for experimentation and study, but that care should be taken to avoid short circuits
  - understand that short circuits may cause wires to heat up, as well as waste the limited amount of energy in batteries.
2. Describe and demonstrate example activities that show that electricity and magnetism are related:

- demonstrate that electricity can be used to create magnetism
  - demonstrate that a moving magnet can be used to generate electricity.
3. Demonstrate and interpret evidence of magnetic fields by use of iron filings, or by use of one or more compasses.
  4. Demonstrate that a continuous loop of conducting material is needed for an uninterrupted flow of current in a circuit.
  5. Distinguish electrical conductors, materials that allow electricity to flow through them, and insulators, materials do not allow the flow of electricity through them.
  6. Recognize and demonstrate that some materials, including resistors, are partial conductors of electricity.
  7. Predict the effect of placing an electrical resistance in a simple circuit with a light bulb or electric motor.
  8. Recognize that the amount of electricity we use in our homes is measured in kilowatt hours.
  9. Interpret and explain:
    - the reading on a household electrical meter
    - efficiency labels on electrical appliances.

### Topic B: Mechanisms Using Electricity

#### Overview

Students apply their knowledge of electricity by building electrical devices for a variety of purposes. Tasks that students are assigned may include such things as making a switch from scrap materials, making a device to control the speed of a motor, making a burglar alarm, and lighting three bulbs from one source. Through work on these tasks, students learn the role of various components and control devices that are part of an electrical system. At the same time, they develop skills of problem solving and working as part of a team.

## General Learner Expectation

*Students will be able to:*

- 5–6 Construct simple circuits, and apply an understanding of circuits to the construction and control of motorized devices.**

## Specific Learner Expectations

*Students will be able to:*

1. Identify example applications of electrical devices in the school and home environment, and classify the kinds of uses. Categories of electrical use may include such things as: heating, lighting, communicating, moving, computing.
2. Design and construct circuits that operate lights and other electrical devices.
3. Recognize the importance of switches and other control mechanisms to the design and operation of electrical devices, and identify purposes of switches in particular applications.
4. Construct and use a variety of switches.
5. Design and construct toys or vehicles that use a battery-powered electric motor to produce motion.
6. Design and construct a burglar alarm.
7. Demonstrate different ways of lighting two lights from a single power source, and compare the results. Student should recognize that wiring two bulbs in series makes both bulbs glow less brightly than if the bulbs are parallel wired. Students may demonstrate this knowledge operationally, and do not need to use the terms series and parallel.
8. Demonstrate different ways of using two batteries to light a bulb, and compare the results. Students should recognize that wiring the batteries in series causes the bulb to glow brighter.
9. Given a design task and appropriate materials, invent and construct an electrical device that meets the task requirements.

## Topic C: Classroom Chemistry

### Overview

Students learn about the properties and interactions of some safe to handle household liquids and solids. They test a variety of materials to see what happens when things are mixed together: what dissolves, what reacts and what remains unaffected. They discover that when a solid material dissolves it can be recovered as a crystal by evaporating the liquid. They also learn that when two materials react to form a new material, the original materials cannot be recovered. As an example of a chemical reaction, students learn to produce carbon dioxide gas and show that this gas differs from ordinary air.

## General Learner Expectation

*Students will be able to:*

- 5–7 Describe the properties and interactions of various household liquids and solids, and interpret their interactions.**

## Specific Learner Expectations

*Students will be able to:*

1. Recognize and identify examples of the following kinds of mixtures:
  - two or more solids; e.g., sand, sugar
  - a solid and a liquid; e.g., sugar, water
  - two or more liquids; e.g., milk, tea.
2. Apply and evaluate a variety of techniques for separating materials where one of the components is a liquid and one is a solid.
3. Distinguish substances that will dissolve in a liquid from those that will not, and demonstrate a way of recovering a material from solution.
4. Demonstrate a procedure for making a crystal.
5. Recognize that the surface of water has distinctive properties, and describe the interaction of water with other liquids and solids.
6. Produce carbon dioxide gas through the interaction of solids and liquids and demonstrate that it is different from air.

7. Distinguish reversible and irreversible changes of materials and give examples of each.
8. Recognize and describe evidence of a chemical reaction. Explain how the products of a reaction differ from original substances.
9. Use an indicator to identify a solution as being acidic or basic.

## Topic D: Weather Watch

### Overview

Students learn about weather phenomena and the methods used for weather study. They learn to measure temperatures, wind speed and direction, and the amounts of rain and snow, and the amount of cloud cover. In studying causes and patterns of air movements, students learn about the effects of uneven heating and cooling and discover the same patterns of air movement in indoor environments as are found out-of-doors. They also learn about human actions that can affect weather and climate, and study the design and testing of clothing used as protection against the weather.

### General Learner Expectations

*Students will be able to:*

- 5–8 Observe, describe and interpret weather phenomena, and relate weather to the heating and cooling of the Earth’s surface.**
- 5–9 Investigate interactions between weather phenomena and human activity.**

### Specific Learner Expectations

*Students will be able to:*

1. Predict where within a given indoor or outdoor environment one is likely to find the warmest and coolest temperatures.
2. Describe patterns of air movement, in indoor and outdoor environments, that result when one area is warm and another area is cool.
3. Describe and demonstrate methods for measuring wind speed and for finding wind direction.

4. Describe evidence that air contains moisture, and that dew and other forms of precipitation come from moisture in the air.
5. Describe and measure different forms of precipitation, in particular, rain, hail, sleet, snow.
6. Measure at least four different kinds of weather phenomena. Either student-constructed or standard instruments may be used.
7. Record weather over a period of time.
8. Identify some common types of clouds, and relate them to weather patterns.
9. Describe the effects of the Sun’s energy on daily and seasonal changes in temperature—24-hour and yearly cycles of change.
10. Recognize that weather systems are generated because different surfaces on the face of the Earth retain and release heat at different rates.
11. Understand that climate refers to long term weather trends in a particular region and that climate varies throughout the world.
12. Recognize that human actions can affect climate, and identify human actions that have been linked to the greenhouse effect.
13. Appreciate how important it is to be able to forecast weather and to have suitable clothing or shelter to endure various types of weather.
14. Test fabrics and clothing designs to choose those that most effectively meet the challenges of particular weather conditions; e.g., water resistant, wind resistant, protection from cold.

## Topic E: Wetland Ecosystems

### Overview

Students learn about wetland ecosystems by studying life in a local pond, slough, marsh, fen or bog. Through classroom studies, and studies in the field, students learn about organisms that live in, on and around wetlands; and about adaptations that pond organisms make life in their environment. Through observation and research, students learn about the interactions among



wetland organisms and the role of each organism as part of a food web. The role of human action in affecting wetland habitats and populations is also studied.

### **General Learner Expectation**

*Students will be able to:*

#### **5–10 Describe the living and nonliving components of a wetland ecosystem and the interactions within and among them.**

### **Specific Learner Expectations**

*Students will be able to:*

1. Recognize and describe one or more examples of wetland ecosystems found in the local area; e.g., pond, slough, marsh, bog, fen.
2. Understand that a wetland ecosystem involves interactions between living and nonliving things, both in and around the water.
3. Identify some plants and animals found at a wetland site, both in and around the water; and describe the life cycle of these plants and animals.
4. Identify and describe adaptations that make certain plants and animals suited for life in a wetland.
5. Understand and appreciate that all animals and plants, not just the large ones, have an important role in a wetland community.
6. Identify the roles of different organisms in the food web of a pond:
  - producers: green plants that make their own food, using sunlight
  - consumers: animals that eat living plants and/or animals
  - decomposers: organisms that reuse and recycle materials that were formerly living, including molds, fungi, insects, worms.
7. Identify examples of each of the roles in item 6 within a wetland ecosystem.
8. Draw a diagram of food chains and food webs, and interpret such diagrams.
9. Recognize that some aquatic animals use oxygen from air and others from water, and identify examples and adaptations of each.
10. Identify human actions that can threaten the abundance or survival of living things in wetland ecosystems; for example, adding pollutants, changing the flow of water, trapping or hunting pond wildlife.
11. Identify human actions taken to preserve and enhance wetland habitats, and identify how each individual has a role to play.
12. Recognize that changes in part of an environment have effects on the whole environment.

## GRADE 6

### SKILLS

*These skills apply to the five topics of study identified for Grade 6. The organization of these skills reflects a general pattern of science activity, not a fixed instructional sequence. At Grade 6, students normally will show independence in exploratory and investigative activities, with limited guidance, mainly in defining problems and selecting appropriate variables. At this level students should be able to describe the purpose of each step followed in investigative activities.*

Science Inquiry	Problem Solving through Technology
<p><b>General Learner Expectations</b>  <i>Students will be able to:</i></p> <p><b>6-1 Work cooperatively with others to design and carry out an investigation in which variables are identified and controlled.</b></p> <p><b>6-2 Recognize the importance of accuracy in observation and measurement, and apply suitable methods to record, compile, interpret and evaluate observations and measurements gathered by self and group.</b></p>	<p><b>General Learner Expectations</b>  <i>Students will be able to:</i></p> <p><b>6-3 Work cooperatively with others in designing and carrying out an investigation of a practical problem and in developing a possible solution.</b></p>
<p><b>Specific Learner Expectations</b>  <i>Students will be able to:</i></p> <p><b>Focus</b></p> <ul style="list-style-type: none"> <li>ask questions that lead to exploration and investigation</li> <li>identify one or more possible answers to their questions by stating an hypothesis or a prediction</li> </ul> <p><b>Explore and Investigate</b></p> <ul style="list-style-type: none"> <li>identify sources for information and ideas, and demonstrate skill in accessing them. Sources may include library, classroom and computer-based resources</li> <li>identify one or more ways of finding answers to given questions</li> <li>work cooperatively with others in developing a shared plan</li> <li>identify specific procedures to be followed</li> <li>identify variables: <ul style="list-style-type: none"> <li>identify the variable to be manipulated</li> <li>identify variables to be held constant</li> <li>identify the variable that will be observed (responding variable)</li> </ul> </li> <li>work individually or cooperatively in carrying out a set or procedures</li> <li>modify the procedures as necessary</li> </ul>	<p><b>Specific Learner Expectation</b>  <i>Students will be able to:</i></p> <p><b>Focus</b></p> <ul style="list-style-type: none"> <li>identify problems to be solved, and the purpose(s) of problem solving activities: What problem(s) are we trying to solve? What resources can we use? How will we know that we have done what we set out to do? What possible impacts do we need to consider?</li> </ul> <p><b>Explore and Investigate</b></p> <ul style="list-style-type: none"> <li>identify sources for information and ideas, and demonstrate skill in accessing them. Sources may include library, classroom, and computer-based resources</li> <li>identify one or more possible approach to solving the problem</li> <li>identify steps to be used in completing the task, and work cooperatively with others in developing a shared plan</li> <li>engage in all parts of the task, and support the effort of others</li> <li>attempt a variety of strategies and modify procedures when needed—troubleshoot problems</li> </ul>

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<p><b>Reflect and Interpret</b></p> <ul style="list-style-type: none"> <li>• communicate effectively with group members in sharing and evaluating ideas, and assessing progress</li> <li>• record observations and measurements accurately, using a chart format where appropriate. Computer resources may be used as a record keeping tool and for display and interpretation of data</li> <li>• evaluate procedures used and identify possible improvements</li> <li>• state an inference based on results. The inference will identify a cause and effect relationship that is supported by observations</li> <li>• identify possible applications of what was learned</li> <li>• identify new questions that arise from what was learned.</li> </ul>	<p><b>Reflect and Interpret</b></p> <ul style="list-style-type: none"> <li>• communicate effectively with group members in sharing and evaluating ideas, and assessing progress</li> <li>• evaluate the product or process developed and identify possible improvements</li> <li>• evaluate procedures used, and identify possible improvements</li> <li>• identify positive and negative impacts that may arise, and potential risks that need to be monitored: What good effects and what bad effects could this solution have? What would we need to look for to be sure that it is working as intended?</li> <li>• identify new applications of the design or problem solution.</li> </ul>
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## ATTITUDES

*These attitudes apply across the five topics of study identified for Grade 6.*

### General Learner Expectation

*Students will be able to:*

**6-4 Demonstrate positive attitudes for the study of science and for the application of science in responsible ways.**

### Specific Learner Expectations

*Students will show growth in acquisition and application of the following traits:*

- curiosity
- confidence in personal ability to learn and develop problem-solving skills
- inventiveness and open-mindedness
- perseverance in the search for understandings and for solutions to problems
- flexibility in considering new ideas
- critical-mindedness in examining evidence and determining what the evidence means
- a willingness to use evidence as the basis for their conclusions and actions
- a willingness to work with others in a shared activity and in the sharing of experience
- appreciation of the benefits to be gained from shared effort and cooperation
- a sense of personal and shared responsibility for actions taken
- respect for living things and environments, and commitment for their care.



## UNDERSTANDINGS

### Topic A: Air and Aerodynamics

#### Overview

Students explore the characteristics of air and the interaction between moving air and solids. They learn that air is a compressible fluid, that it is composed of many gases, and that moving air can support solid materials in sustained flight. By studying birds and airplanes, they learn a variety of adaptations and designs that make flight possible and provide for propulsion and control.

#### General Learner Expectation

*Students will be able to:*

#### **6–5 Describe properties of air and the interactions of air with objects in flight.**

#### Specific Learner Expectations

*Students will be able to:*

1. Provide evidence that air takes up space and exerts pressure; identify examples of these properties in everyday applications.
2. Provide evidence that air is a fluid and is capable of being compressed; identify examples of these properties in everyday applications.
3. Describe and demonstrate instances in which air movement across a surface results in lift—Bernoulli's principle.
4. Recognize that in order for devices or living things to fly, they must have sufficient lift to overcome the downward force of gravity.
5. Identify adaptations that enable birds and insects to fly.
6. Describe the means of propulsion for flying animals and for aircraft.
7. Recognize that streamlining reduces drag, and predict the effects of specific design changes on the drag of a model aircraft or aircraft components.
8. Recognize that air is composed of different gases, and identify evidence for different gases. Example evidence might include effects on flames, the “using up” of a

particular gas by burning or rusting, and the animal needs for air exchange.

### Topic B: Flight

#### Overview

Students apply their knowledge of aerodynamics to designing, building and testing a variety of flying devices. In constructing models, students develop a basic design, then build it, test it, and solve the problems that inevitably arise. Through team work they learn that planning, communication, cooperation and flexibility are important to the overall result, even though parts of a task can be worked on individually. In the process, students learn about the parts of an aircraft, their role in controlled flight, and the differences between aircraft and spacecraft.

#### General Learner Expectation

*Students will be able to:*

#### **6–6 Construct devices that move through air, and identify adaptations for controlling flight.**

#### Specific Learner Expectations

*Students will be able to:*

1. Conduct tests of a model parachute design, and identify design changes to improve the effectiveness of the design.
2. Describe the design of a hot air balloon and the principles by which the rising and falling of a hot air balloon are controlled.
3. Conduct tests of glider designs, and modify a design so that it will go further, stay up longer, or fly in a desired way; for example, fly in a loop, turn to the right.
4. Recognize the importance of stability and control to aircraft flight, and design, construct and test control surfaces.
5. Apply appropriate vocabulary in referring to control surfaces and major components of an aircraft. This vocabulary should include: fuselage, vertical and horizontal stabilizer, aileron, rudder.

6. Construct and test propellers and other devices for propelling a model aircraft.
7. Describe differences in design between aircraft and spacecraft, and identify reasons for the design differences.

**Note:** Model aircraft or rockets may be constructed and used as part of this unit. It is recommended that these models be simple devices of the student's construction, not prefabricated models. Propulsion of rockets by chemical fuels is neither required nor recommended, due to safety considerations.

## Topic C: Sky Science

### Overview

Students learn about objects in the day and night sky. Through direct observation and research students learn about the motions and characteristics of stars, moons and planets. Using simple materials, such as balls and beads, students create models and diagrams, which they use to explore relative position and motion of objects in space. As a result of these studies, students move from a simple view of land and sky, to one that recognizes the Earth as a sphere in motion within a larger universe. With new understanding, students revisit the topics of seasonal cycles, phases of the Moon and the apparent motion of stars.

### General Learner Expectation

*Students will be able to:*

- 6–7 Observe, describe and interpret the movement of objects in the sky, and identify pattern and order in these movements.**

### Specific Learner Expectations

*Students will be able to:*

1. Recognize that the Sun and stars emit the light by which they are seen, and that most other bodies in space, including Earth's

- Moon, planets and their moons, comets and asteroids, are seen by reflected light.
2. Describe the location and movement of individual stars and groups of stars (constellations) as they move through the night sky.
3. Recognize that the apparent movement of objects in the night sky is regular and predictable, and explain how this apparent movement is related to Earth's rotation.
4. Understand that the Sun should not be viewed through a telescope, light filter or directly without taking proper safety precautions.
5. Construct and use a device for plotting the apparent movement of the Sun over the course of a day; e.g., construction and use a sundial or shadow stick.
6. Describe seasonal changes in the length of the day and night and in the angle of the Sun above the horizon.
7. Recognize that the Moon's phases are regular and predictable, and describe the cycle of its phases.
8. Illustrate the phases of the Moon in drawings, and by use of improvised models. An improvised model might involve such things as a table lamp and a sponge ball.
9. Recognize that the other eight known planets, which revolve around the Sun, have characteristics and surface conditions that are different from the Earth, and identify examples of those differences.
10. Recognize that not only Earth, but other planets, have moons, and identify examples of similarities and differences in the characteristics of those moons.
11. Identify technologies and procedures by which knowledge about planets and other objects in the night sky have been gathered.
12. Understand that Earth, the Sun and the Moon are part of a solar system that occupies only a tiny part of the known universe.

## Topic D: Evidence and Investigation

### Overview

Students sharpen their skills in observing and interpreting what they see by investigating evidence of human and animal activity. They explore and analyze indoor and outdoor environments as they look for footprints, markings, evidence of disturbance and things that are left behind. Through these studies students learn to pose questions, devise investigations, recognize patterns and discrepancies, and think logically about what they have observed.

### General Learner Expectations

*Students will be able to:*

- 6–8 Apply observation and inference skills to recognize and interpret patterns, and to distinguish a specific pattern from among a group of similar patterns.**
- 6–9 Apply a knowledge of the properties and interactions of materials to the investigation and identification of a material sample.**

### Specific Learner Expectations

*Students will be able to:*

1. In a natural outdoor setting, recognize evidence of recent human activity, and recognize evidence of animal activity.
2. Observe a set of footprints and infer the direction and speed of travel.
3. Recognize that evidence found at the scene of an activity may have unique characteristics that allow an investigator to make inferences about the participants and nature of the activity, and give examples of how specific evidence may be used.
4. Investigate evidence and link it to a possible source by:
  - classifying fingerprints collected from a variety of surfaces
  - classifying footprints, tire prints and soil samples from a variety of locations
  - analyzing the ink from different pens, using paper chromatography

- analyzing handwriting samples to identify the handwriting of a specific person
- comparing samples of fabric.

## Topic E: Trees and Forests

### Overview

Students learn about trees, as individual plants and as part of a forest ecosystem. By examining local species they learn to recognize the characteristics of different trees and develop skill in describing and interpreting their structural features. As part of their studies, students learn about a broad range of living things found on, under and around trees and study the complex interaction between trees and the larger environment. In examining human use of forests they become aware of a broad range of environmental issues and develop an awareness of the need for responsible use.

### General Learner Expectation

*Students will be able to:*

- 6–10 Describe characteristics of trees and the interaction of trees with other living things in the local environment.**

### Specific Learner Expectations

*Students will be able to:*

1. Identify reasons why trees and forests are valued. Students meeting this expectation should be aware that forests serve as habitat for a variety of living things, and are important to human needs for recreation, raw materials, and for a life-supporting environment.
2. Describe kinds of plants and animals found living on, under and among trees; and identify how trees affect and are affected by those living things.
3. Describe the role of trees in nutrient cycles and in the production of oxygen.
4. Identify general characteristics that distinguish trees from other plants, and characteristics that distinguish deciduous from coniferous trees.



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5. Identify characteristics of trees found in the local environment. Students should be familiar with deciduous trees and two coniferous trees. Examples should include spruce, birch, poplar, and cultivated species, such as crabapples.
6. Describe and classify leaf arrangements, branching patterns, and overall form of a tree.
7. Interpret the growth patterns of trees, distinguishing this year's growth from the previous year, and find evidence of that. Students meeting this objective should recognize different growth patterns and texture of new growth and locate scars that separate old growth.
8. Identify human uses of trees for modern and historical purposes.
9. Identify human actions that threaten the existence of trees.
10. Identify an issue regarding trees. Identify different perspectives on the issue and identify actions that can be taken to address the issue.

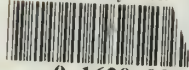
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